



REVIEW

Fatal and Nonfatal Severe Jellyfish Stings in Thai Waters

Peter J. Fenner, AM, MD (London), FACTM, FRCGP,*† John Lippmann, OAM, BSc DipEd,‡ and Lisa-Ann Gershwin, PhD§

*School of Public Health, Tropical Medicine and Rehabilitation Sciences, James Cook University, Townsville, Queensland, Australia; †Travel Medicine Mackay, North Mackay, Queensland, Australia; ‡Divers Alert Network Asia-Pacific, Melbourne, Victoria, Australia; §Queen Victoria Museum and Art Gallery, Launceston, Tasmania, Australia

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On November 3, 2008, the Governor of Phuket released a media statement: “people throughout the region should be alerted to the dangers of box jellyfish.”¹ Two days later, the Minister for Natural Resources and the Environment also released: “People swimming in the sea where box jellyfish are present should exercise caution.”² Quickly, travel advisories were posted on numerous government web sites, including Australia, United States, and Thailand. Internet search provides a modest estimate of the confusion this caused, as most people, previously unaware of the problem, were now demanding to know about the appearance of this danger, and how?

General consensus was that fatal and severe jellyfish stings were new to Thailand, whereas we argue that they have long occurred throughout the Indo-Pacific, including Thailand (Nakorn, personal communication).³ We summarize and review current knowledge on life-threatening jellyfish stings in Thailand, hoping this report will provide a stimulus for improved awareness and management of jellyfish problems throughout Southeast Asia.

Two kinds of potentially deadly jellyfish are confirmed in Thai waters: chirodropid box jellyfish and Irukandji box jellyfish (L. Gershwin, unpublished data). Hundreds of other species of jellyfish are also present but are not considered as life threatening.

Chirodropids are large box-shaped jellyfish (ie, “box jellyfish”) with multiple tentacles arising from each of the four lower corners of the bell.

Irukandji are easily distinguished from chirodropids, as their box-shaped body has just a single tentacle at each lower corner.

Chironex kill by massive envenomation, causing respiratory arrest or cardiac arrest in systole in as

little as 2 to 3 min. Their stings have caused multiple human fatalities throughout the Indo-Pacific, including the Maldives, southern India, Myanmar, the Malaysian archipelago (east and west coasts), Indonesia, Brunei, Sarawak, Sabah, the Philippines and Solomon Islands, Okinawa (Japan), and Australia (Nakorn, personal communication).^{3–8}

At least two confirmed Irukandji deaths have occurred in Australia, probably more, given that the sting leaves little or no mark, and later symptoms resemble acute myocardial infarction (AMI), cerebrovascular accident, or even drowning.^{9–11} Irukandji syndrome has also been confirmed from Hawaii, Florida, the Caribbean, North Wales (UK), New Guinea, and throughout the tropical Pacific.^{5,6,9}

Chirodropids appear mainly in the summer months in the northern and southern hemispheres, usually during the local rainy or monsoonal season, and most commonly around sandy beaches near mangrove areas. Their season is longest at the equator, where it can last all year, and reduces moving toward both Tropics. Irukandji are also commonest in the warmer months, although seasonal patterns of some different species⁹ in Australia have been recorded all months of the year and are probably similar elsewhere.¹²

Methods

Sting case histories were gathered from a variety of sources: PubMed searching keywords “Thailand” and “jellyfish” provided four relevant publications; most case histories were obtained through Thai physicians, Divers Alert Network reports, witnesses, media, and e-mail contacts. These reports are certainly a significant underestimation of the true occurrence of fatal or severe stings in Thailand.

Diagnoses of “box jellyfish sting” and “Irukandji syndrome” were made by standard acceptance.

Chirodropids—causing sudden severe skin pain, obvious severe whip-like skin marks (often on the legs

Corresponding Author: Peter J. Fenner, AM, MD (London), FACTM, FRCGP, Travel Medicine Mackay, PO Box 3080, North Mackay 4740, Queensland, Australia. E-mail: pjf@occupationalhealthmackay.com.au

from shallow water), rapid reduction of consciousness, and life-threatening breathing and/or cardiac problems.

Irukandji-like species cause a sting that may or not cause skin pain, followed some 10 to 30 minutes later by characteristic severe systemic symptoms called the “Irukandji syndrome” and include severe back pains, muscle cramping, headache, nausea, vomiting, sweating, trouble breathing, anxiety, and a feeling of restlessness and “impending doom.”

Results

The first reported human fatality from a jellyfish sting in Australia occurred on December 5, 1884, the first in the Indo-Pacific in 1907 in the Philippines.⁸ Subsequent fatalities occurred in Malaysia, Solomon Islands, “Borneo,” Papua New Guinea,^{5,6} and Thailand.^{3–5,9} Specific investigations suggest some 20 to 50 deaths occur annually in the Philippines, but are unknown to most people, even Filipino officials.^{5,13,14}

Deaths have occurred in Thailand for many years with early reports not Medline listed^{5,6}: a 1999 fatality reported in this journal,³ and two fatalities in the same area about 24 hours apart in 2002.^{15,16} However, in 2008, major publicity on fatalities in Thai waters caused alarm to the Thai government and Thai tourism. Photos confirming large carybdeids (ie, Morbakka-type Irukandji) and large chirodropids (box jellyfish) have since been submitted by divers in Thai waters (Divers Alert Network sources).

Early Sting Reports

Research was conducted in small villages around the Andaman Sea, west Thailand, by Williamson and Hartwick on August 10, 1985.¹⁷ Local fishermen recognized chirodropids and their stings when shown photos, and associated them with the hot, still weather and calm water of “summer”; many admitted to stings but did not know of deaths.

Fatal Chirodropid Stings

1996

In May 1996, two teenagers died after jellyfish envenomation near Pantai Cenang in Pulau Langkawi, off the southwest coast of Malaysia bordering Thailand.^{6,18} Their rapid demise and characteristic skin markings implied a chirodropid, with *Chiropsoides buitendijki* blamed. A 24-year-old sibling was also stung escaping with “nasty lacerations” (see Figure 1).

1999

On October 20, 1999, a 26-year-old male British tourist swimming in early evening calm seas off Chaweng Beach, Koh Samui³ suddenly exited the water, walking unsteadily and calling for water to drink. Within minutes he collapsed, stopped breathing, and became pulseless. At a nearby hospital, dilated, nonreactive pupils were noted on arrival shortly afterwards. Extensive typical

chirodropid welts were present across his neck, chest, and back. Resuscitation was unsuccessful.

2002

On August 9, 2002, a 25-year-old Australian male died from massive leg stings, wading in waist-deep water late in the afternoon off Hat Rin Nok Beach, Koh Pha Ngan Island.^{15,16} He exited the water, collapsed on the beach, stopped breathing, and was pulseless within 5 minutes. Despite immediate resuscitation, 15 minutes later in hospital an electrocardiogram (ECG) showed asystole.

The next day, August 10, 2002, a 23-year-old Swiss female was stung on chest, arms, body, and legs off a beach on Koh Pha Ngan.¹⁵ She collapsed within minutes and received immediate resuscitation but arrested twice more during transfer to hospital at nearby Koh Samui, before succumbing some 12 hours postenvenomation.

2008

On April 3, 2008, around 10 AM, an 11-year-old Swedish female died after being stung by jellyfish on Klong Dao Beach, Koh Lanta.¹⁹ She and three other girls (similar ages) were paddling and playing in water 1 m deep, about 20 m from the beach. The girls screamed, attracting the attention of hotel staff, who ran into the water to assist. The girl was pulled from the water but was blue and pulseless some 4 minutes postenvenomation despite CPR and application of vinegar and a locally obtained salve. The others received minor stings but survived, one requiring hospitalization, the other two treated at the beach.

Severe, Potentially Life-Threatening Stings

Chirodropids (Multi-tentacled Box Jellyfish)

2004. A 7-year-old male was stung on the left forearm, left thigh, and trunk by an unknown jellyfish while wading at Pattaya Beach, the exact date unstated.²⁰ He developed contact dermatitis and acute renal failure with hemoglobinuria with renal biopsy showing acute tubular necrosis. Supportive treatments improved both dermatitis and renal function.

2007. On December 27, 2007, in Koh Mak, a 6-year-old male, his mother and father were all stung by a jellyfish, 3 m from a beach restaurant.²⁰ Another young female from eastern Europe also received a painful sting. They were treated immediately with a local “potion” which stopped the pain “in seconds” and left no scars.

The next day, December 28, 2007, a 46-year-old male was stung by over 2 m of tentacle at Koh Mak.²¹ A woman at a nearby beach restaurant used a (possibly the same) “wonderful” local potion, leaving “no skin marks.”

On December 30, 2007, at a sandy beach also on Koh Mak, a 4-year-old male wading in 30 cm of water where others were swimming and snorkeling, received a large sting.²² Within seconds he became unconscious, apnoeic, and cyanosed. Two minutes after dousing



Figure 1 Map of fatal and severe jellyfish stings in Thai waters (map from www.cia.gov). Deaths colored red; severe stings colored yellow.

with about 1.5 L of vinegar, he spontaneously regained consciousness. He spent 3 days in Trat hospital but has permanent scarring over his legs (Figure 2). His parents received minor stings while rescuing him.

Subsequent anecdotal evidence revealed that another boy almost drowned in deep water nearby after a minor sting the year before.²²

2008. On April 18, 2008, at about 5 PM, a 47-year-old male received a sting in 1 m of water fronting the Marriott Hua Hin (200 km SW of Bangkok), in

the western Gulf of Thailand.²¹ The victim's wife saw the jellyfish (described as a "box jellyfish" 20–30 cm in diameter with 3–4 finger-like tentacles, 15–20 cm long) as a wave dumped it on her husband's forearm. He had received several previous jellyfish stings in Thailand (see incident December 28, 2007, above), although this was more severe. The skin marks were similar to this previous sting, although the jellyfish in Koh Mak looked "younger" (cleaner and clearer) than this one that had a brownish–bluish bell. This time, the victim was taking "heavy treatment for allergy" which possibly mitigated



Figure 2 The wounds on the leg of the small boy stung at Koh Mak on January 30, 2007. These wounds show the typical pattern of a chirodropid sting.

the initial impact but had no effect on the skin damage. Topical cortisone was applied, seemingly helping reduce the severe skin pain. The victim's forearm was swollen for a couple of days, with reddish sting marks remaining for 3 weeks before becoming necrotic, breaking down to welts 0.5 cm deep taking 4 months to repair, leaving linear scars.²¹

On December 21, 2008 at Bungalow Bay, west Koh Racha Yai, south of Phuket, a 49-year-old male diver at a 6 m decompression stop noticed a chirodropid about 16 cm from his face.²¹ It was difficult to see underwater having a transparent bluish bell some 25 cm² with many tentacles about 16 cm long from the four corners. One of the tentacles brushed against his hand. Back on board the boat, he had severe finger pain, like it "had been cut open." He woke three times that night with pain. It remained painful for weeks, the wound dehiscing despite alternate applications of local anesthetic and antibacterial creams.

Irukandji Syndrome

Thai medical and tourism personnel were unaware that Irukandji and their syndromes occurred in Thailand. However, recent interviews with Thai tourism personnel, medical staff, fishermen, and sting victims regularly describe stings with "breathing difficulty" attributed to anaphylactic shock (L. Gershwin, unpublished notes, April 2009). These stings typically occurred during periods of onshore breezes, when the incidence of "sea lice" (ie, pin-prick stings caused by hydromedusae) was higher than normal—similar to conditions coincident with Irukandji stings in Australia.

2001. In February 2001, de Pender et al.²³ reported a sting to a 46-year-old Dutch female, swimming in the sea at Ban Koong i Tham. Twenty minutes after an acute burning sting on the left arm waves of pain started in the whole arm, with "severe head, shoulder,

lower back, and limb pain, profuse sweating, recurrent vomiting, and collapse. A lifeguard recorded several blood pressure readings of 180/140 mm Hg." She was admitted to the Coronary Care Unit, diagnosed as a non-Q wave myocardial infarction but was discharged after 2 days. Back in the Netherlands, tests revealed no cardiac damage although "an electric pain" persisted in her left arm, improving slowly over 3 weeks. She recovered fully in 6 weeks.

2007. On December 13, 2007, a 35-year-old dive instructor was stung while diving off the island of Koh Tao²¹ when he hung his left arm over the mooring line at the safety stop. Back on board, while removing his wetsuit top, he experienced sharp, severe pain from a red mark on the inside of his left elbow, resembling three small "cuts." The pain extended along his arm, into his axilla, and into his abdomen and his chest became "tight" causing difficulty in breathing. He had palpitations, felt unwell, and felt "he would die," symptoms resembling the Irukandji syndrome. He was placed on oxygen and evacuated to hospital.

His initial ECG suggested that he had a "heart rhythm disturbance" and was managed for a suspected AMI (although the subsequent medical report suggested the initial ECG was "normal"). The arm sting marks had now gone and the diver, who claimed to have been clearheaded throughout, did not remember any marks, or complaining of being stung. This absence of any clear indication or suspicion of envenomation almost led to him being inappropriately recompressed in a chamber for suspected DS. He remained hospitalized for 4 days and recovered very slowly over several weeks.

2008. On April 30, 2008, a fit 40-year-old British tourist diver was diving near Pattaya wearing a sleeveless suit without a hood.²¹ While ascending, he felt a sharp pain on the back of his head. Reaching back, he felt a tentacle which wrapped around his arm. He described the pain as burning and very severe, scoring it at 10/10. The tentacle was around 70 cm long, had a brownish appearance with tinges of purple and white spots. He immediately surfaced and on the dive boat vinegar was applied, removing remaining traces of tentacle.

However, he quickly became nauseous and started vomiting with severe abdominal epigastric cramps. He started shivering, developed a severe headache, felt dizzy, tight across the chest, dyspnoeic, and briefly became unconsciousness. Despite being placed on oxygen, waves of vomiting, severe abdominal cramps, arm and head pain continued as he was rushed to hospital.

On admission, some 3 hours later, he was hypertensive and still had abdominal cramps. There were spiral erythematous marks with surrounding inflamed painful skin lesions over both arms and scalp (Figure 3).

The pain decreased with analgesia and anti-inflammatories, but the abdominal colic remained. He



Figure 3 The wound of the arms of the diver stung near Pattaya on April 30, 2007. The offending tentacle is likely to have come from a large carybdeid.

was discharged after 18 hours but 4 hours later, the severe abdominal cramps returned and he vomited blood. He returned to the hospital and was given Buscopan 20 mg IV; Metoclopramide 20 mg IV; Pethidine 50 mg IV; Esomeprazole 40 mg IV 12 hourly; Cephalexin 500 mg qd; Fexofenadine 60 mg bd; and Betamethazone N cream applied to the sting marks before he settled.

Discussion

Attributing jellyfish stings to particular species is typically problematical. Often, signs and symptoms such as red patches, whitish wheals, pain, and tenderness can occur from a wide variety of species' stings. Sticky-tape or skin-scraping samples may be helpful for identification in some cases,²⁴ but are rarely taken and require expert identification.²⁵ The two most reliable types of stings to diagnose in the field or in a clinical context are from chirodropids and Irukandjis, as described above. For the Thai cases herein, the signs and symptoms were almost a perfect match with those in Australia. We have confirmed the presence of both large chirodropids and at least two types of Irukandji jellyfish in Thailand, all new to science (Gershwin: i.d. photos held by Divers Alert Network); it remains unclear at this time how many life-threatening jellyfish species live in Thai waters, or which ones were responsible for each case.

Several stings detailed above were treated with a local potion said to help. This may have been a local plant, *Ipomoea pes-caprae*, used by Thai fisherman with reported success to both prevent and treat jellyfish stings^{26,27} and found in abundance along tropical seashores in both hemispheres.

Recent fatal stings in Thailand were first attributed to "global warming."²⁸ However, severe stings and fatalities have long been present in Thailand and surrounding waters. What is "new," however, is the

widespread recognition of the problem and a whole-of-government approach to managing it.

In December 2008 and April 2009, Australian experts gave seminars and workshops in Thailand to educate the Government and tourism bodies how to reduce stings in line with the current advice in Australia. Commencing in July 2009, a grant from the Australian Government (through the Australia–Thailand Institute—Department of Foreign Affairs) is funding Thai scientists and physicians to visit Australia to learn state-of-the-art marine stinger prediction, prevention, and treatment from a variety of experts around the country. These proactive safety measures will enable the standard to be set for other countries in the Indo-Pacific.

Conclusions

These cases demonstrate a need to update sting prevention strategies, targeting the highest risk populations and activities.

"Prevention is better than cure"—tourists must be made aware of the danger and alternates made available to them. Honest and accurate educational material must be freely available and provided by tourism agencies arranging holidays in Thailand and other Indo-Pacific Countries where the problem exists, and be freely available at the airports and resorts. Beaches need restricted access, with walkways to them having signs warning of possible dangerous jellyfish presence. These signs must be multilingual and/or with translation easily available by digital access—including phonetic language. Vinegar should be freely available on all beaches together with provision of stinger-resistant nets, where the beach profile allows, with suitably trained lifeguards to reduce sting possibilities. In areas where nets cannot be fitted, swimming pools make excellent substitutes. Provision of protective clothing by tourism operators should be mandatory in areas of swimming, snorkeling, diving, or other in-water activities. Stings and even fatalities will never be prevented completely; however, such measures would greatly reduce the possibility of serious envenomations and will not detract from tourism; they will enhance it, secondary to improved safety.

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Declaration of Interests

P. F. was the Marine Stinger Advisor with Surf Life Saving Queensland from 1985 to 2005: the National Medical Officer, Surf Life Saving Australia 1995–2005. He was a coauthor on the textbook.⁹

J. L. is the Executive Director of Divers Alert Network Asia-Pacific and is the Principal Investigator on a research grant from the Australia–Thailand Institute through the Department of Foreign Affairs and Trading, Australia.

L.-A. G. was the National Marine Stinger Advisor with Surf Life Saving Australia from 2005 to 2007. Since 2007, she has been on the Medical Advisory Panel for St John Ambulance Australia and the Director of the Australian Marine Stinger Advisory Services.

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